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APPENDIX G

Title : Radio Frequency Local Area Network

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PHYSICAL LAYER SPECIFICATION

Introduction.

This document describes the physical characteristics of communications links used by devices in the SST network. Medium access techniques mentioned in this document are further defined in the MAC layer specification.

Communication Link Types.

Six physical communication link types have been defined for devices in the SST network:

1) Direct-sequenced Spread Spectrum Radio.
2) IEEE 802.3.
3) RS485 LAN.
4) RS485 Passive Bus.
5) RS232 Point-to-point.
6) V.35

(In addition, multiple RS422 links can be used to control and communicate with UHF base stations which coexist in the SST network; however the UHF base stations are not considered as part of the SST network.)

Only the first three link types are used for communications within the SST network. The passive bus link type is used for off-line batch communications to Norand devices. RS232 is used for communications with various devices, including host computers, printers, etc. RS232, V.35 and 802.3 can all be used to provide a controller-to-host-computer link.

Direct-sequenced Spread Sprectrum Interface.

Spread spectrum radio provides wireless communications for online terminals in a mobile environment. Spread spectrum radio links are also used to extend the range of wired radio base stations. The wireless base station option facilitates ease of installation and changes in base station topology.

The spread spectrum channel frequency is 902 to 928 mhz.

IEEE 802.3 (ethernet) Interface.

The IEEE 802.3 interface provides a LAN industry standard backbone channel for the Norand SST network. Controllers and/or base stations can be distributed, as required, on an 802.3 LAN to provide radio coverage for spread spectrum terminals. A Norand proprietary wired backbone is not required. In addition, an 802.3 LAN can provide the link to a host computer.

802.3 support is implemented with an optional LAN interface module, available on controllers and high-end base stations. Each device which supports the 802.3 interface has a twisted-pair compatible RJ45 connector, and a thin coaxial cable compatible BNC connector. Support for thick coaxial cable networks must be provided with an off-the-shelf thin-to-thick adaptor module.

The IEEE 802.3 standard is defined in the ISO 8802-3 standard.

RS485 LAN (type 1) Interface.

The RS485 LAN or type 1 interface provides an inexpensive medium-speed wired backbone network for devices in the SST system. The RS485 LAN is designed to minimize delay for sporadic transaction-oriented communications in a, primarily, online environment; however, efficient batch communications is also supported on the backbone.

Type 1 network characteristics are listed below:

- LAN architecture.
- EIA RS485 physical link.
- 460.8 Kbps link speed.
- Bit-synchronous data link protocol.
- FM0 data/clock encoding scheme.
- Access to the link is through p-persistent CSMA hardware and software.
- Link terminations may be AC coupled.
- Up to 32 devices are allowed per LAN link segment before a repeater is required.
- Link segment lengths up to 1000 feet are allowed before a repeater is required.
- A collision avoidance mechanism is provided for acknowledgments and batch traffic.

The type 1 LAN standard is hierarchical in the sense that all type 1 devices must also support the type 2 interface described below.

The 460.8 Kbps standard was chosen because:

- 460.8 is an even multiple of conventional baud rates (i.e. 48 x 9600).
- The 230.4 Apple Localtalk standard can be achieved by simply dividing the rate by two.
- A Zilog 8 Mhz 8530 SCC with a 7.3728 Mhz PCLK can achieve the 460.8 Kbps rate (FM0 encoding or asynchronous) by gating PCLK to the receive clock input. The 7.3728 Mhz PCLK is required to achieve conventional baud rates, up to 115.2 Kbps, with the 8530 baud rate generator. Many off-the-shelf communications products are implemented with the 8530 chip.

RS485 Passive Bus (type 2) Interface.

The RS485 passive bus interface is designed to reduce contention for batch communications with devices in the SST network and existing DSD terminals. The type 2 interface provides a passive bus for multidropped terminals. A master controller device regulates access to the bus by slave terminal devices.

Devices on the RS485 passive bus are not "online" in the SST network. Access to a host computer is through an RS485 port on a controller device.

Type 2 network characteristics are listed below:

- Bus architecture.
- EIA RS485 physical link.
- 115.2 Kbps link speed.
- Access to the link is directed by a "master" controller.
- The access method is essentially TDM. A single device owns part of the channel for an entire file transfer session.
- NRZ asynchronous data encoding.
- Up to 32 devices per link segment are allowed before a repeater is required.
- Link segment lengths up to 1000 feet are allowed before a repeater is required.
- Link terminations are DC coupled.

The 115.2 Kbps asynchronous standard was chosen because:

- 115.2 is an even multiple of conventional baud rates (i.e. 12 x 9600).
- The 115.2 Kbps speed can be implemented with an interrupt driven or polled UART on slower devices.
- 4000 DSD terminals are capable of 115.2 Kbps asynchronous RS485 communications.

RS232 Point-to-point (type 3) Interface.

The RS232 type 3 interface is required to interface with off-the-shelf RS232 devices, host computers, and existing Norand RS232 equipment (i.e. printers). RS232 devices must support link speeds up to 38.4 Kbps. Type 1 devices should support bit-synchronous RS232 communications. All devices must support asynchronous RS232 communications.

Example 1.

Figure 1.1 illustrates the use of some of the physical link types described above.

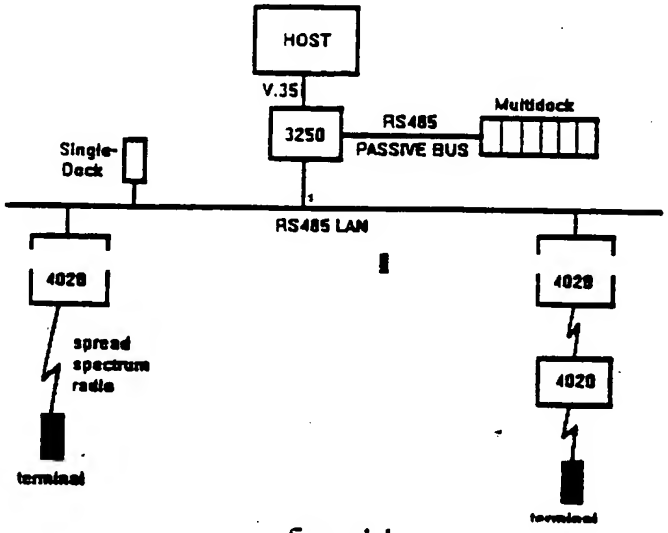

figure 1.1

Example 2.

Figure 1.2 illustrates how an 802.3 LAN can be used as the backbone in an SST network. Note that it is possible to intermix 802.3 and RS485 links in the same SST network.

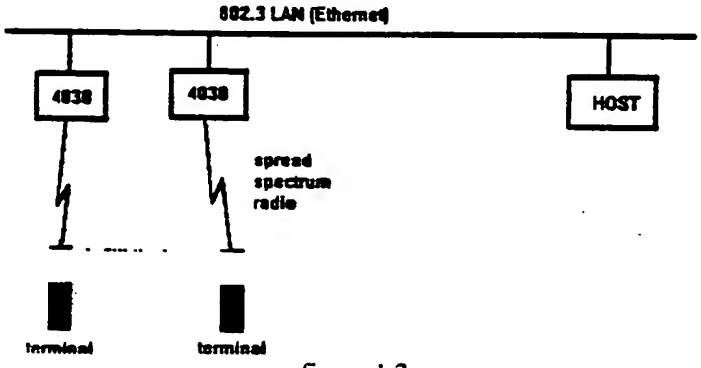

figure 1.2